CLAIMS

What is claimed is:

1. A semiconductor laser, comprising:

a first optical gain element that generates a first light beam having a first optical frequency;

a second optical gain element that generates a second light beam having a second optical frequency;

a nonlinear optical element to create a polarization wave having a third optical frequency; and,

a plurality of electrical contacts that generate a spatially alternating electric field that phase matches the polarization wave to a third light beam having the third optical frequency.

2. The laser of claim 1, wherein the third optical frequency is in a range from the Infrared to the THz regions.

3. The laser of claim 1, wherein said electrodes have opposite polarities.

4. The laser of claim 1, wherein said nonlinear optical element includes a waveguide optically coupled to said first and second gain elements.

5. The laser of claim 1, further comprising a diffraction grating tuned to the third optical frequency of the third light beam.

6. The laser of claim 1, wherein the semiconductor laser is fabricated with group III-V material.

7. The laser of claim 6, wherein the spatially alternating electric field modulates a nonlinear susceptibility of the group III-V material.

8. A semiconductor laser, comprising:

gain means for generating a first light beam having a first frequency and a second light beam having a second frequency;

mixing means for creating a polarization wave having a third optical frequency; and,

matching means for generating a spatially alternating electric field and phase matching the polarization wave to a third light beam at the third optical frequency.

9. The laser of claim 8, wherein the third frequency is in a range from the Infrared to the THz regions.

10. The laser of claim 8, wherein said matching means includes a plurality of electrodes that have opposite polarities.

11. The laser of claim 8, wherein said mixing means includes a waveguide.

12. The laser of claim 8, further comprising a diffraction grating tuned to the third optical frequency of the third light beam.

13. The laser of claim 8, wherein the semiconductor laser is fabricated with group III-V material.

14. The laser of claim 13, wherein the spatially alternating electric field modulates a nonlinear susceptibility of the group III-V material.

15. A method for operating a semiconductor laser, comprising:

generating a first light beam having a first frequency;

generating a second light beam having a second frequency;

mixing the two beams to generate polarization wave having a third optical frequency, and,

generating a spatially varying electrostatic field that phase matches the polarization wave to a third light beam with the third optical frequency.

16. The method of claim 15, wherein the third optical frequency is in a frequency from the Infrared to the THz regions.

17. The method of claim 15, wherein the first and second light beams travel along a waveguide.

18. The method of claim 15, wherein the spatially alternating electric field is generated by a plurality of electrodes having opposite polarities.

19. The method of claim 15, wherein the spatially alternating electric field modulates a nonlinear susceptibility of a material of the semiconductor laser.

20. A semiconductor laser, comprising:

a first optical gain element that generates a first light beam having a first frequency;

a nonlinear optical element to create a polarization having a second optical frequency and a third optical frequency by optical parametric oscillation; and,

a plurality of electrical contacts that generate a spatially alternating field that phase matches the polarization wave to the third optical frequency.

21. The laser of claim 20, wherein the third optical frequency is in a range from the Infrared to the THz regions.

22. The laser of claim 20, wherein said electrodes have opposite polarities.

23. The laser of claim 20, wherein said nonlinear optical element includes a waveguide optically coupled to said first and second gain elements.

24. The laser of claim 20, further comprising a diffraction grating tuned to the third optical frequency of the third light beam.

25. The laser of claim 20, wherein the semiconductor laser is fabricated with group III-V material.

26. The laser of claim 20, wherein the spatially alternating electric field modulates a nonlinear susceptibility of the group III-V material.